

WHAT IS CLAIMED IS:

1. A precision marking system to place reference markers on an object that comprises:

a work surface on which the object is placed;

an object locator system to determine the location and orientation of the object and features within the object relative to the work surface;

a multiple axis robot, wherein positioning the multiple axis robot is directed by a control system; and

at least one end-effector operable coupled to the multiple axis robot to place reference markers on the object, wherein the end-effector further comprises:

an ink delivery system;

a pulsed valve to regulate the supply of ink from the ink delivery system;

a pick shaped stylus operable coupled to the pulsed valve to receive ink from the pulsed valve, and wherein the pick shaped stylus has an internal orifice through which the ink is dispensed from the end-effector and onto the object.

2. The precision marking system of Claim 1, wherein the ink delivery system further comprises an ink reservoir operably coupled to a positive displacement pump.

3. The precision marking system of Claim 1, wherein the ink delivery system further comprises a positive pressure pneumatic reservoir delivery system.

4. The precision marking system of Claim 1, wherein the pick shaped stylus provide radial clearance around the orifice.

5. The precision marking system of Claim 1, wherein the work surface comprises a shuttle table.

5 6. The precision marking system of Claim 5, wherein the shuttle table further comprises a series of vacuum support pins in a predetermined arrangement for a given object.

10 7. The precision marking system of Claim 1, wherein the object locator system further comprises a vision end-effector to locate the object within a work envelope.

8. The precision marking system of Claim 1, wherein the multiple axis robot further comprises a 6-axis gantry robot.

15 9. The precision marking system of Claim 1, wherein the reference markers provide alignment information for additional objects to be mechanically coupled to the object.

20 10. The precision marking system of Claim 1, wherein the reference markers provide part identification information.

11. The precision marking system of Claim 1, wherein the reference markers provide assembly information to a user.

25 12. The precision marking system of Claim 1, wherein the object further comprises an aircraft understructure.

30 13. The precision marking system of Claim 1, wherein the end-effector is oriented to place reference markers on the surface of the object.

14. The precision marking system of Claim 1, wherein the end-effector is oriented to place reference markers on walls located at an angle to the surface of the object.

5           15. The precision marking system of Claim 1, further comprises a calibration system operable to calibrate each end-effector when selected.

10           16. The precision marking system of claim 1, wherein the end-effector is stored within a storage rack when not operable coupled to the multiple axis robot.

          17. An end-effector to place reference markers on an object that comprises:

15           a fluid delivery system;

          a pulsed valve to regulate the supply of fluids from the fluid delivery system; and

20           a pick shaped stylus operable coupled to the pulsed valve to receive fluids from the pulsed valve, and wherein the pick shaped stylus has an internal orifice through which the fluids are dispensed from the end-effector and onto the object.

25           18. The end-effector of Claim 17, wherein the ink delivery system further comprises an ink reservoir operably coupled to a positive displacement pump.

30           19. The end-effector of Claim 17, wherein the ink delivery system further comprises a positive pressure pneumatic reservoir delivery system.

          20. The end-effector of Claim 17, wherein the pick shaped stylus provide radial clearance around the orifice.

21. The end-effector of Claim 17, wherein the end-effector is operably coupled to a multi axis robot within a precision marking system.

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22. The end-effector of Claim 21, wherein the precision marking system further comprises:

a work surface on which the object is placed;

an object locator system to determine the location and

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orientation of the object and features within the object relative to the work surface; and

the multiple axis robot, wherein positioning the multiple axis robot is directed by a control system.

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23. The end-effector of claim 17, wherein the fluids further comprise inks, paints, epoxy, or adhesives.